Single-step, surfactant-free polymerization of amphiphilic block copolymers in water (2016-015)

Ultra-high molecular weight block copolymers synthesized for use in clinical and industrial technologies.

Market Overview

There is a growing need for polymers in various applications such as drug delivery, product coatings, adhesives, and even semiconductors. The overall market for controlled radical polymerization products has been estimated to be worth roughly $20 billion. However, this expanding market needs solutions for long-standing issues including polymer processing times, material costs, and other manufacturing parameters. Clemson University researchers have developed a novel method of polymer synthesis to address these challenges. This approach has been shown to reduce processing times by creating a single step procedure, and can eliminate the use of surfactants in emulsion polymerization. Additionally, this technology produces ultra-high molecular weight block polymers that are unachievable by traditional methods. Such advancements allow for easier and more cost efficient production of block polymers from a manufacturing perspective.

Application

Latex paints, Coatings, Fluorocopolymers, Injection molding

Stage of Development

Preliminary prototype

Advantages

- Provides a single-step synthesis procedure, reducing reaction times required from several hours or days to under one hour.
- Surfactant-free polymerization reduces the need for materials, minimizing processing costs.
- Ultra-High Molecular Weight (UHMW) copolymers can be synthesized, forming phase-separated morphologies for a broad range of applications.

Technical Summary

This copolymer synthesis method allows for single-step synthesis of amphiphilic block copolymers without the need of surfactants. The polymerization initially involves the formation of water-soluble homopolymer blocks, followed by copolymerization of a hydrophobic monomer. This results in ultra-high molecular weight polymers controlled by heterogeneous reaction conditions and a continuous supply of initiator. These heterogeneous reaction conditions allow for phase separation of hydrophilic and

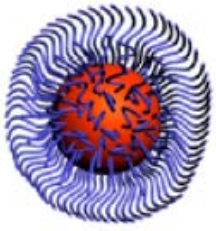

Figure 1: Aggregate structure of the amphiphilic block copolymers.

For More Information Contact: Andy Bluvas | bluvasa@clemson.edu | (864) 656-0797 | CURF Reference No. 2016-015

hydrophobic monomers to facilitate more efficient polymerization under the initiator-starvation conditions. Through phase-separated synthesis, Clemson researchers have been able to create various colloidal nanoparticles that comprise ultra-high molecular weight polymers.

App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Provisional	United States	62/420,221	NA	2016-015	Dr. Marek W. Urban

About the Inventor

Dr. Marek W. Urban is the Sirrine Foundation Endowed Chair and Professor in the Department of Materials Science and Engineering at Clemson University. He earned his Ph.D. in Chemistry and Chemical Engineering from Michigan Technological University and was also a postdoctoral fellow in the Department of Macromolecular Science at Case Western Reserve University. In his career Dr. Urban has published over 380 research papers, authored four books, patented several technologies, and served as the editor of seven books on chemical processes. He has been recognized on multiple occasions by the American Chemical Society, the National Science Foundation, and has been featured across various media. Dr. Urban's current research focuses on the design and synthesis of heterogeneous, self-healing, and stimuli-responsive polymers for a variety of applications.

For More Information

To learn more about this technology, please contact:

Andy Bluvas

Technology Commercialization Officer

bluvasa@clemson.edu

(864) 656-4935